



## **Rapidly responding to data center changes with structured cabling**

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**Introduction**

Over the past 10 years, the data center environment has expanded beyond the traditional glass house (mainframes and attached storage devices) to include distributed server networks and storage area networks (SANs). To increase the performance and availability of these data management networks, companies are migrating the overall system configuration from the traditional, dedicated server-to-storage direct connection to a switched server-to-storage shared connection using fiber optic cabling. The migration to switched connections enhances overall system availability and data throughput, but, at the same time, greatly increases the complexity of the fiber optic cabling.

Because of this increase in connection sophistication, the need for planning fiber optic cabling systems has never been greater. A properly designed fiber optic cabling system is an essential component that can help you manage system complexity and facilitate future growth and reconfiguration.

This white paper compares two generic methods of implementing fiber optic cabling in the enterprise data center that are used today:

- *Direct point-to-point connections between system equipment ports, using discrete fiber optic (two-fiber) jumper cables*
- *A structured fiber optic cabling system, using a centralized connection area known as a central patching location (CPL)*

The comparison looks at how each method affects three critical factors in managing overall system availability:

- *Reducing the amount of time required to plan system changes that include fiber optic cabling changes*
- *Reducing the actual system downtime required for system upgrades and changes*
- *Reducing the amount of time required to recover from an unsuccessful system change*

### Direct point-to-point connections

The point-to-point connection method uses discrete fiber optic (two-fiber) jumper cables that run directly between the active system equipment. Each fiber optic jumper cable connects a single port of one device to a single port of another device. This is often the default method for data center cabling because it requires little up-front investment or planning. Additional fiber optic jumper cables are added as needed.

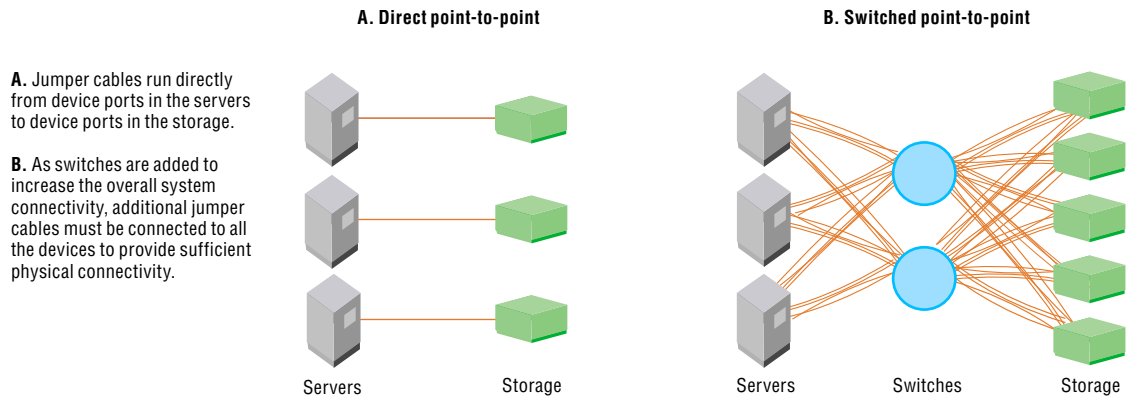
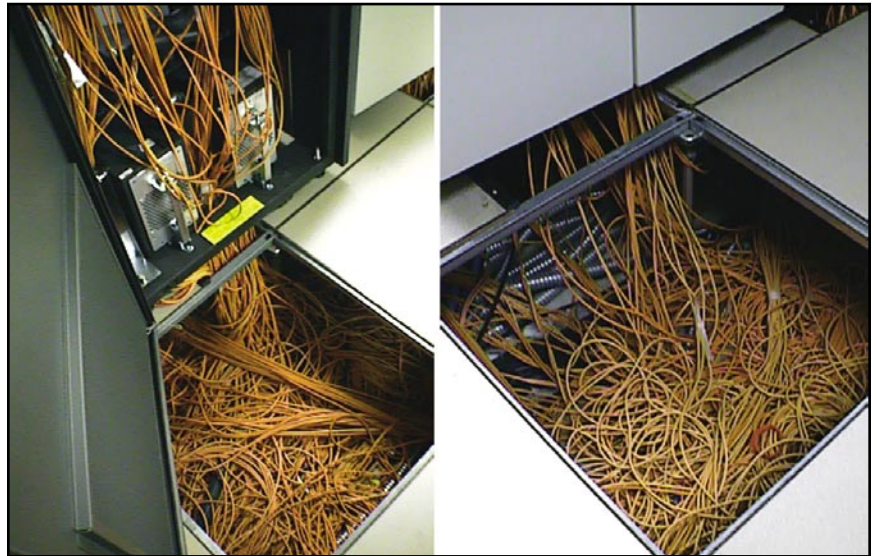


Figure 1. Growing complexity of point-to-point connections

Figure 1 illustrates how cabling with discrete fiber optic jumper cables starts simply, but the complexity quickly grows as switches are added into the system hardware configuration.

The direct point-to-point connections seem, at first glance, to be the simplest and most cost-effective method. As you add new equipment to the system, you simply run additional fiber optic jumper cables under the raised floor to connect the new equipment to the existing system. Indeed, fiber optic jumper cables have become a commodity in today's data center environment with many suppliers offering them, even over the Internet. However, as both Figure 1 and Figure 2 illustrate, the simplest direct point-to-point connections become complicated as a system grows and switches are added. Fiber optic jumper cables are installed under the floor and fan out to connect servers to switches and switches to storage devices, without an organized management approach. Soon it is difficult to determine the origin or termination points of any of the fiber optic jumper cables.



*Figure 2. Actual fiber optic jumper cable installations*

The usual method of installing fiber optic jumper cables is also a result of the uneven growth that many data centers experience. The uneven growth results from unexpected user demands and system upgrades. Hardware technology and software applications continue to change, providing IT managers with difficult choices every day.

In a global marketplace, internal and external forces impact the decision-making process. You are constantly confronted with the following questions:

- *Can you add new applications and new users, perform system upgrades and still reduce complexity?*
- *Can you perform a system upgrade to facilitate growth, while efficiently managing the change to the fiber optic cabling infrastructure?*
- *Can you keep pace with your competitors and respond rapidly to change by reducing the planned outage window?*

This fast-paced, often reactive, environment can lead to a lack of long-term planning, especially when it comes to fiber optic cabling. It is this lack of planning, without a systematic approach, which leads to tangles of orange (and now yellow) discrete fiber optic jumper cables under the raised floor. The longer the cable chaos is allowed to exist, the more difficult it becomes to rectify. With this type of fiber optic cabling, if a system upgrade yields unsatisfactory results, will it take minutes to restore the pre-change system configuration, or will it take hours?

How can cable chaos be avoided? How can fiber optic cabling be planned and managed so that it actually helps you manage the system? The answer: use a systematic approach to fiber optic cabling that includes documented cable pathways, designated cabling connection change areas and a methodology that enables most of the change activity to occur independent of the planned system outage window.

### Structured fiber optic cabling system

The second method of implementing data center fiber optic cabling is using a structured cabling system. This method uses multifiber trunk cables and fiber optic connection panels (known as *patch panels*) to establish defined cable pathways and designated cabling connection change areas in the physical cabling design. As soon as these known cable pathways and cabling connection change areas are established, the fiber optic cabling for system hardware modifications can be isolated to the designated change areas in the cabling infrastructure. This greatly simplifies cabling modifications by managing the change activity in the defined locations rather than disconnecting, moving and reconnecting discrete fiber optic jumper cables scattered under the raised floor.

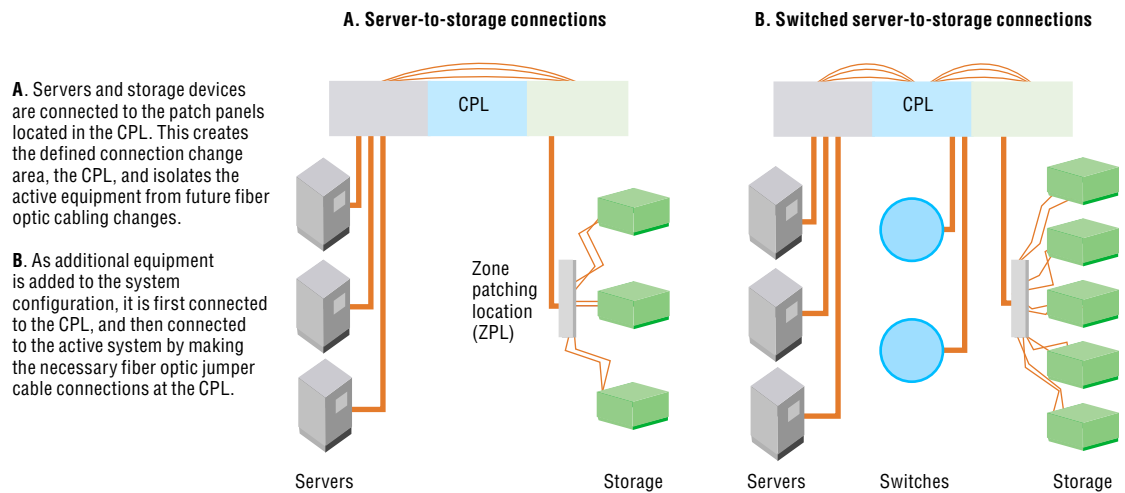


Figure 3. Structured fiber optic cabling

The structured fiber optic cabling system approach, illustrated in Figure 3, shows how the system approach connects all the device ports to the main or CPL. This approach relocates the equipment ports away from the active, running equipment and creates a designated cabling connection change area. The actual server-to-storage connections are made at the CPL, using short, manageable fiber optic jumper cables that are not placed under the raised floor.

When switches are added to this system to increase the connectivity (see Figure 3-B), they are connected to their patching (change) area in the CPL, prior to any active system change activity. This establishes the static cable pathways and change areas for the switches.

The switches can then be quickly and easily connected into the system configuration by making the appropriate cabling connections at the CPL during a scheduled system downtime. This creates a repeatable methodology for adding and changing equipment connections to the active system, and results in much less cabling change activity during the scheduled downtime change window. It also isolates the fiber optic cabling change activity away from the active equipment.

### **Managing change**

The major difference between the two cabling methods is the ability to help manage change, planned and unplanned. The direct point-to-point connection method has fiber optic jumper cables running under the raised floor between the active equipment. The exact routes of the cables are usually not well documented, and only the end points are known, based on some sort of label on each end of the fiber optic cable. The cabling usually becomes a tangled mess under the floor, which makes rerouting the cables difficult. When system cabling changes are made with the point-to-point connection method, the system equipment doors must be opened, service professionals unplug and plug fiber optic jumper cables inside the active equipment, and cables are pulled back and rerouted under the floor. All this activity puts the system connections and equipment at risk. The amount of system risk is impossible to predict. It creates the greatest problem with the direct point-to-point connection method: the unpredictable impact on the existing system, from the initial, planned system change and the attempt to recover quickly if the change needs to be backed off to restore the system to a pre-change configuration.

The impact of fiber optic jumper cabling changes on the point-to-point connection method is shown in Figure 4. The figure shows how system change activity can affect most parts of the system. If problems occur, the same change activity must be made again across the system – opening the doors to the equipment, moving cables back under the floor and plugging cables – to restore the system to the pre-change configuration. That’s too much risk to take. According to industry-standard project management training, the best way to remove risk from a plan is to identify the risk and find a remedy, prior to starting the project.

Direct point-to-point fiber optic jumper cables are located virtually everywhere in the data center, impacting the ability to accurately manage cabling changes.

The actual cabling changes can occur almost anywhere in the system hardware configuration. Predicting the impact of this much change is nearly impossible and should be avoided.

**How difficult would it be to return the system cabling to its pre-change configuration?**

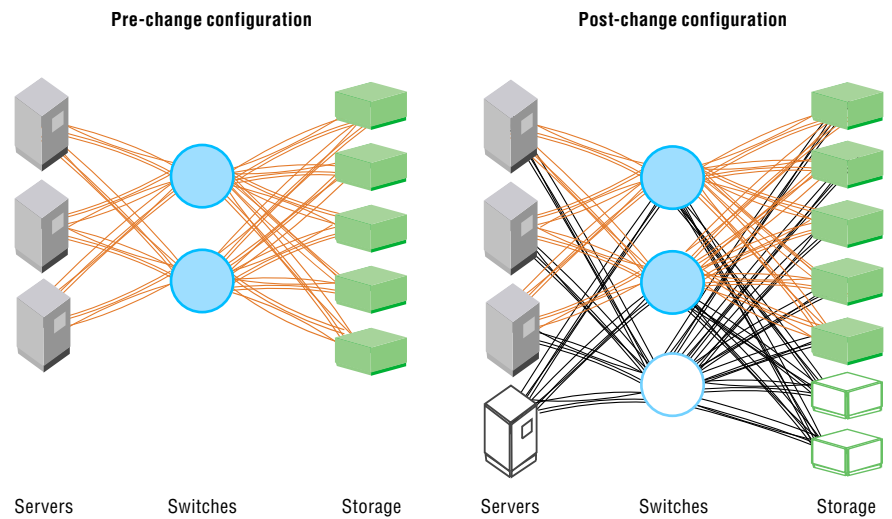


Figure 4. Impact of fiber optic jumper cabling changes with direct point-to-point connections

With the direct point-to-point connection method, the ability to identify cabling change risks beforehand is difficult. The experienced IT manager knows the best way to reduce the risk of change is to schedule system downtime before performing the necessary changes. How much downtime is required? Try to schedule some buffer time and you probably will not get the approval; schedule too little time and the changes might not be completed on time and the scheduled downtime becomes an unscheduled outage. With the direct point-to-point connection method, the fiber optic jumper cables are scattered under the raised floor. Therefore, as part of the change activity, every system change requires someone to validate the cabling to ascertain the correct cables are moved. A plan must then be created to show how all the cables can be restored to their pre-change configuration if problems arise.

These extra planning activities, required for every system change involving fiber optic jumper cabling changes to the direct point-to-point connection method, translates into service time, with one of two outcomes:

- *Extra cost and slower reaction to system upgrades if the planning activities are completed*
- *Extra risk and possible, unplanned system outages if the planning activities are not completed*

Either way, what appeared to be a cost savings with the direct point-to-point connection method vanishes quickly as the real costs to manage and reduce the risks become apparent.

How can the structured fiber optic cabling system help reduce the planning time and system-recovery time associated with system changes? And how does it enable the overall system to respond faster to unexpected capacity demands with less overall risk?

Managing change with a structured fiber optic cabling system is illustrated in Figure 5. The figure shows how the structured system isolates the change activity to the defined areas.

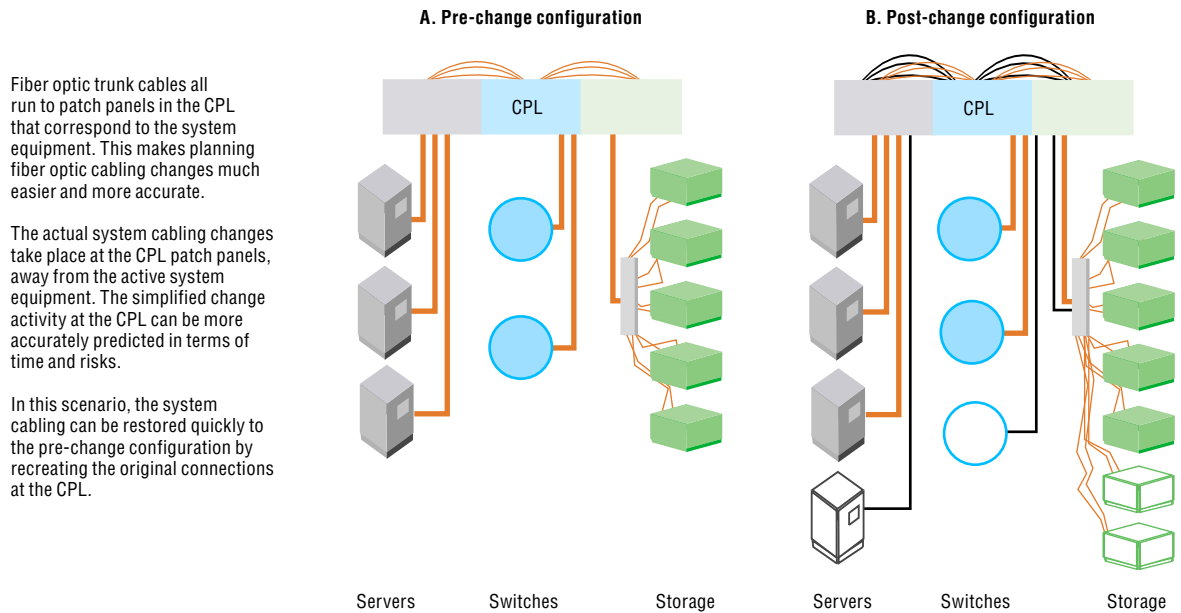


Figure 5. Managing change with a structured fiber optic cabling system

First, the new equipment is connected to the CPL without impacting the active system so no scheduled downtime is required. Then, the new equipment can be connected to the active system during the scheduled downtime by simply reconfiguring the fiber optic jumper cables (patch jumpers) at the CPL.

In the event of a problem with the change, you have to disconnect only the new equipment from the system at the CPL and reconnect the fiber optic jumper cables at the CPL to their pre-change configuration – not difficult at all. That, along with connecting the new equipment into the system in the first place, helps enable the IT manager to better predict the time required to implement a change and the time required to recover from it if the change must be reversed. This can mean easier, faster changes that introduce less risk and enable improved overall system response.

### **Benefits of structured fiber optic cabling**

Benefits of structured fiber optic cabling include the potential for greater or earlier return on investment (ROI), improved scalability and around-the-clock availability—all to help reduce cost and save time.

### ***Return on investment***

A key decision criterion for infrastructure investment is your ROI. A properly planned data center fiber optic cabling infrastructure can play an important role in:

- *Reducing system operational cost*
- *Reducing system outage time*
- *Increasing the system availability level*
- *Maintaining business continuity*
- *Promoting longevity of the infrastructure*

Planned outages that run too long and unplanned outages can have the same hourly impact on a business. A properly designed solution for a data center infrastructure, such as a structured fiber optic cabling system, can result in reduced outage planning time, more predictable outage windows and less time to recover from unsuccessful system changes. This leads to decreased installation and maintenance time, as well as increased system availability.

### ***Scalability***

Supporting scalability and easy manageability, with the least impact to the data center operation, is critical. Eventually, any successful system will need to handle more applications and more data. Do you know how the proposed infrastructure solution will manage and support the hardware growth needed to increase system capacity?

Today's data center environments are:

- *Multivendor oriented*
- *Run by many different parties, such as hardware vendors, installers, customer engineers and service providers (outsourcing)*
- *Usually growing irregularly and unpredictably*

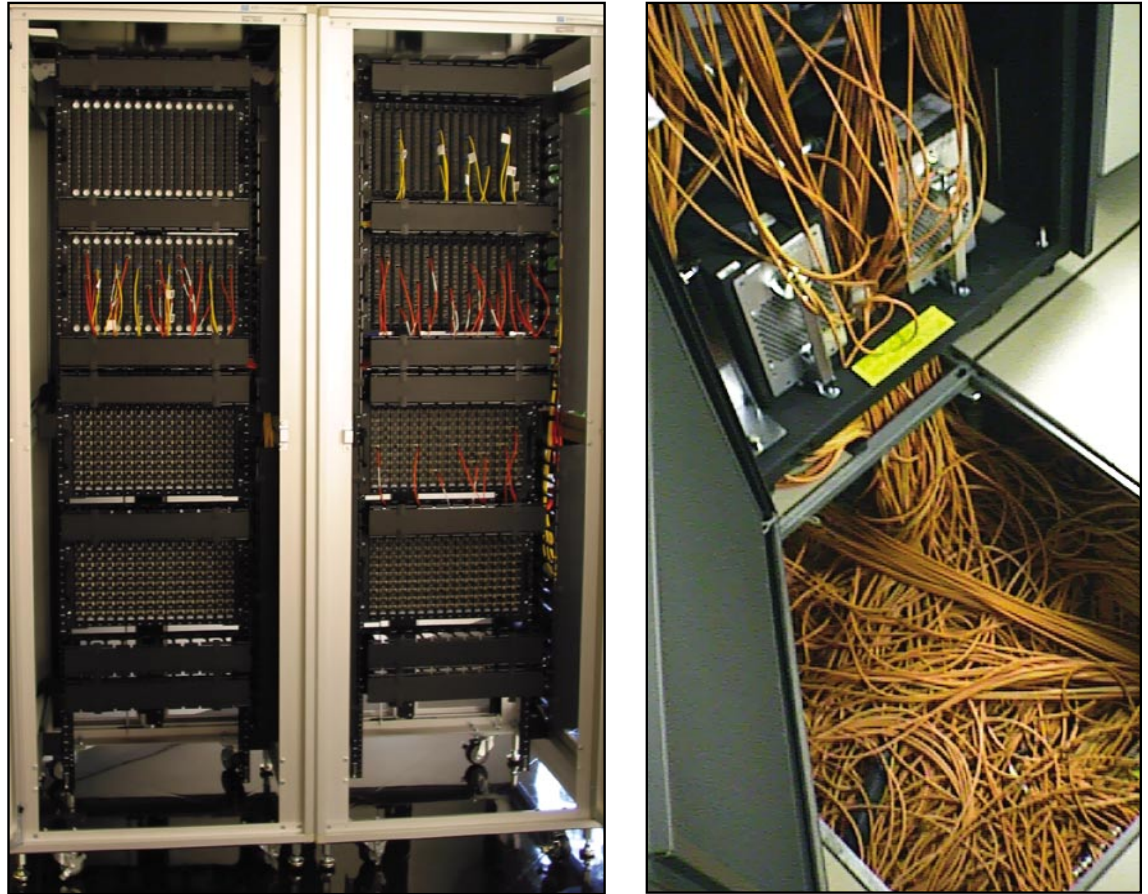
These diverse and complex environments need a common base: a structured fiber optic cabling system to manage all connections to the hardware and the network.

### ***Availability***

While maintaining flexibility, data centers are expected to operate 24 hours a day and 365 days a year without disruption. Any change in the data center configuration must be planned carefully and must be synchronized with other activities to help limit outages. This synchronization must be fully supported by the design of the data center infrastructure.

Availability is the most important requirement of a data center. The IT department spends considerable time and effort supporting data center availability. However, it is not enough to look only at data center hardware. Backup hardware and mirroring concepts will not pay off if the cabling – often hidden under the raised floor – does not provide the same design quality (for example, redundancy to support fast problem determination and error recovery).

During the life of a data center, storage devices, switches, directors and even servers will be added and upgraded. The structured fiber optic cabling system approach can enable you to plan and implement these critical changes faster and with reduced risk.



*Figure 6. The photo on the left shows fiber optic patch panels installed in distribution cabinets as part of a structured fiber optic cabling system. Here at the CPL, moving or replacing a connection is made easier and with less risk because the cables are neat and connections are made above the raised floor where the correct cable is easily found. Compare this neatness and order to the cabling confusion in the picture on the right. Where would you rather make your critical system changes?*

### **Summary**

Today's data center environment is expanding to include distributed server networks and SANs. These networks use fiber optic cabling to handle 1-Gbps and faster data rates required to keep up with ever faster server and storage processing speeds. How the fiber optic cabling is implemented and managed can have a profound effect on the system's ability to respond to upgrades and equipment moves, adds and changes.

The method that seems to be the simplest and most cost-effective, the direct point-to-point connection method, actually becomes the method that adds the most cost by increasing the required planning time for each system change and increasing the risks as well.

The structured cabling method uses a proven, systematic approach to fiber optic cabling by documenting cable pathways and cable change locations. This approach isolates the change activities away from the active equipment and helps reduce both the planning time required for each system change and the potential risks.

The benefits of a structured fiber optic cabling system include helping you accomplish decreased installation and management time and increased system availability, along with a positive potential ROI. Scalability can be achieved with the modular design of the structured cabling system. Availability is optimized in a data center using a structured fiber optic cabling system by reducing sources of failure and the time required for equipment moves, adds and changes.

The best time to implement a structured fiber optic cabling system is when the system is new. However, because this is not the case in most data centers, the task of migrating a system from point-to-point to a structured cabling design must be implemented in steps. The migration plan requires a structured fiber optic cabling solution partner that understands both the system equipment and the cabling requirements. Selecting the right cabling solution provider is critical to helping improve manageability of the data center, reduce both planned and unplanned outages and increase data center availability.

### **For more information**

To learn more about IBM Global Services or IBM Network Integration and Deployment Services for enterprise fiber cabling, contact your IBM representative or visit

**ibm.com**/services/networking/





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